T-2.5-1-KC1-BW(J)

LEPEL

TECHNICAL MANUAL

MP MASTER
MA29108

INSTRUCTION MANUAL
FOR
INDUCTION HEATING
GENERATOR

T-2.5-1-KC1-BW (J)

LEPEL CORPORATION

59-21 QUEENS MIDTOWN EXPRESSWAY, MASPETH, N.Y.C. 11378 • (212) 426-4580

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152E100G11	Outline-Phase Control LPC, Cross Electronics Inc.	

* Applicable Drawing Enclosed

SAFETY FIRST

DANGER: HAZARDOUS VOLTAGES ARE PRESENT INSIDE THE CABINET.

PANEL INTERLOCKS DO NOT REMOVE ALL THE VOLTAGE FROM WITHIN THE CABINET.

OPEN THE MAIN DISCONNECT BEFORE SERVICING THE EQUIPMENT.

WARNING: If the interlocks are disabled, and the main circuit breaker is on with a panel open, lethal voltages may be exposed.

Equipment should be serviced by qualified personnel only.

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SECTION 1

1. DESCRIPTION

1.1 General

This Lepel induction heating generator is designed to deliver to an appropriate inductively coupled load 2.5 KW of high frequency energy in the range of 250 kHz to 800 kHz.

The generator is certified to conform to the Federal Communications Commission Rules and Regulations, Part 18, Subpart 'D" (Industrial Heating Equipment).

1.2 Electrical

The generator consists of three elements:

1.2.1 Control System

A control system that includes the pushbuttons, meters, pilot lights, safety interlocks, relays and contactors.

1.2.2 DC Supply

A high voltage DC power supply that incorporates a transformer and a solid state full wave bridge rectifier. The AC input to the transformer is varied by a Primary Saturable Core Reactor that in turn, varies the high voltage DC level and consequently that RF power output. Power output is variable from approximately 10 to 100 per cent.

1.2.3 Oscillator

A modified hartley oscillator that converts direct current to radio frequency power.

A tapped tank coil and variable grid coil provide the flexibility required to match a wide range of workpieces and load coils to the generator output.

1.3 Specifications

RF Power Output	2.5KW in accordance with IEEE Standard No. 54
RF Output Frequency Range	Refer to the 'Output Frequency Ranges', sheet supplied with this manual. PAGE 2A
Power Input (Single Phase)	5.5 KVA
Input Line Voltage (Single Phase)	230 Volts
Full Load Current	24 Amps
Power Factor (Full Load)	90%
Cooling Water Supply	
Flow	3 GPM
Pressure (at inlet)	40 PSI to 65 PSI
Temperature (at inlet)	80°F (maximum)
Oscillator Tube	Lepel Stk. No. 018-0004
Filament Voltage	12.6 VAC $\pm$ .63 VAC
Filament Current	33 Amps
DC Plate Voltage	4.4 KV
DC Plate Current	.83 Amps (Maximum)
DC Grid Current	165 MA to 250 MA

OUTPUT FREQUENCY RANGES
for
LEPEL GENERATORS

Check the nameplate on the generator to determine the frequency designation and then check this sheet to establish the corresponding output frequency ranges.

DESIGNATION		KC CHART	
KC	→	5KW	
		7.5KW	
		10KW	200-450 KHz
		15KW	200-400 KHz
		20KW	160-400 KHz
		25KW	200-400 KHz
		30KW	
		35KW	
		40KW	160-350 KHz
		50KW	150-350 KHz
		60KW	150-350 KHz
		75KW	
		80KW	
		100KW	150-350 KHz
		250KW	
KCS	400 - 450 KHz		
KC1	160 - 800 KHz		
KC2	80 - 200 KHz		
KC3	80 - 400 KHz		
KC4	325 - 475 KHz		
KC5	140 - 450 KHz		
KC6	160 - 240 KHz		
KC7	370 - 475 KHz		
KC8	120 - 220 KHz		
KC9	100 - 175 KHz		
KC10	80 - 160 KHz		
KC11	250 - 600 KHz		
KC12	400 - 600 KHz		
KC13	225 - 350 KHz		

MC	2.5 - 8 MHz
MC1	15 - 30 MHz
MC2	30 - 50 MHz
MC3	2.2 - 3 MHz
MC4	15 - 40 MHz
MC5	2.5 - 5 MHz

	KC	MC	MC
DF	See 'KC Chart'	2.5 - 8 MHz	—
DF1	—	2.5 - 8 MHz	15 - 30 MHz
DF2	—	15 - 30 MHz	30 - 50 MHz
DF3	See 'KC Chart'	15 - 30 MHz	—
DF4	See 'KC Chart'	2.5 - 5 MHz	—

NOTE: Refer to the installation instructions that are supplied with the generator FCC Certification, for a list of FCC prohibited operating frequencies.

1.3 Specifications (Cont'd)

Rectifiers	
Solid State	Lepel Stk. No. 016-0034
Time delay relay setting (for warm up of the oscillator tube filament)	15 Seconds
Cabinet	
Width	31 $\frac{1}{2}$"
Depth	19 $\frac{1}{2}$"
Height	24"
Weight	330 lbs.

1.4 Output Power Control

1.4.1 Manual Output Power Control

The power output of the generator is controlled manually by means of a 0 - 9.0 VDC (0.5 amp) control signal. This control signal is applied to the control winding of the primary saturable core reactor (PSCR) and varies the impedance of the PSCR. The PSCR is connected in series with the primary winding of the plate transformer.

The control signal is obtained from an adjustable auxiliary power supply which uses a variable transformer to control its output. The MANUAL CONTROL, on the front panel of the generator, adjusts the variable transformer.

1.4.2 Automatic Output Power Control (Optional)

Generators equipped with a PSCR may be converted to automatic power control by adding an SCR driver (Lepel stock no. 050-0009). The impedance of the PSCR is controlled by the SCR driver. A variable 0 - 5 ma dc signal drives the SCR driver.

This setup makes it possible to regulate the output power of the generator by means of a 0 - 5 ma dc control signal. This control signal is obtained from the interior of the generator, or from an external temperature controller or programmable signal source.

The SCR driver is added at extra charge.

The BIAS and GAIN controls on the SCR driver have been calibrated at the factory for a 0-5 ma dc control signal.

An insulated screwdriver must be used to adjust these controls.

Interaction between these controls necessitates that adjustments to the controls be repeated until the desired control signal range is obtained. The possible control signal ranges are 0-20 and 4-20 ma dc. The selected control signal range adjusts output power from minimum to maximum levels. Refer to drawing no. 152E100G11 for procedure to adjust these controls.

The functions of the BIAS and GAIN controls are as follows:

BIAS control - sets input signal level that corresponds to minimum RF output power.

GAIN control - sets input signal level that corresponds to maximum RF output power.

SECTION II

2. UNPACKING AND INSPECTION

Before opening the carton inspect the shipment for any sign of damage.

Cut the metal strapping from the carton, remove all the nails from around the skid base and raise the carton straight up, intact.

The oscillator tube is packed separately, using special materials for absorbing transient shocks. Nevertheless, rough handling can develop internal defects which must be checked for immediately upon delivery. An ohmmeter is adequate for making preliminary tests. The circuit between the filament terminals should be of a very low resistance, conversely, the circuit between filament and grid, filament and anode, and grid and anode should have a resistance in excess of several megohms.

Also packed separately is the grid resistor (R4), footswitch assembly (Stk. No. 043-0008)

These components should also be inspected for damage before attempting to install the generator.

If these inspections reveal any damage or if the resistance readings of the oscillator tube proves faulty, report the facts to the carrier immediately and advise your Lepel representative.

All components were tested prior to shipment.

The carrier is responsible for all damage caused in transit including 'concealed damage'.

Remove the left, right, top and rear panels and taking care not to cut or displace the grid drive pulley cord remove all blocking and packing material used to eliminate vibration and abrasion in transit.

SECTION III

3. INSTALLATION

WARNING: The main power supply must remain 'OFF' until the entire installation is completed.

3.1 Electrical

3.1.1 Power Line and Ground Connections

Provide a 3 wire single phase electrical service using flexible cable or conduit, equipped with a fused disconnect switch adequate to supply the generator power requirements. (See 'Specifications' page 2 and generator Installation Specifications, Drawing No. 9570041).

Satisfactory performance of the equipment is dependent upon the use of a constant voltage power supply. Variations in line voltage will shorten the life of the oscillator tube and cause unstable operation. A ground connection is provided on the rear base of the generator and should be connected by a #6 wire or preferably a copper strip, about 1/16 x 2" to a good ground such as a waterpipe that runs directly into the earth near the generator.

A satisfactory substitute for a waterpipe is a single piece of clean copper or brass rod of at least 1/2" diameter that has been driven vertically into the earth close to the generator, to a depth of at least 8 feet. (Refer to National Code, 'Made Electrodes'.) A low impedance connection (e.g. a copper strap 1" wide x 32" thick) should also be provided between

3.1.1 (Cont'd)

this terminal and any metallic jigs or fixtures which are used in conjunction with the work coil. This is necessary to eliminate voltages generated in the fixture by the coupling existing between the fixtures and the work coil. A second ground terminal, is provided near the circuit breaker for grounding the third wire of the 3-wire, single phase electrical service.

3.1.2 Oscillator Tube

Inspect the oscillator tube socket and remove any foreign matter that might prevent the proper seating of the tube. Remove the sealing gasket from the oscillator tube carton, coat it lightly with silicon grease or petroleum jelly and slip it over the anode of the tube. Insert the tube, with the gasket in place, into the socket and fasten the knurled collar water tight.

CAUTION: Install filament and grid connectors securely as shown in 'Oscillator Tube Connections', page 25.

3.1.3 Grid Resistor

The grid resistor mounts in the clips provided on insulating standoffs located on the vertical dividing wall of the generator frame.

3.2 Water Supply

The cooling water supply should be capable of delivering 3 GPM at a pressure of 40 PSI to 65 PSI.

Fluctuations in the water flow may result in the interruption of

3.2 Water Supply (Cont'd)

generator operation.

A shut-off valve must be used to service fixtures and other accessories requiring water cooling.

Connect a water strainer to the generator water inlet and the flow switch, to the water outlet from the oscillator tube. (See 'Water Control Diagram, page 25). If water flow is inadequate, water flow switch will disconnect power to the filament circuit.

Electrical connections for the water flow switch are to be made at the terminal strip marked "Water Switch" located near the water terminal assembly.

NOTE: A water recirculator, utilizing a water to air heat exchanger is recommended for use in areas where the water supply is unsuitable for cooling purposes due to high mineral content (hardness exceeds 170 PPM), low resistivity (less than 5000 Ω/cm), erratic pressure or very low water temperature.

3.3 Water Drain

To insure proper drainage, the water outlets should lead to an open (gravity) drain capable of handling a greater flow of water than that specified for the generator cooling requirements. It should be located close enough to the generator to allow the operator to visually monitor the water flow. When the use of an overhead drain is unavoidable install a check valve in the drain line near the generator to prevent the reverse flow of water.

If the generator water outlet temperature exceeds 115°F, the water thermostat switch will open de-energizing the filament and plate circuits.

NOTE: Lepel High Frequency Laboratories, Inc. has a staff of field engineers who are available to install or to supervise the installation of Lepel induction heating equipment.

If Lepel installation service is required, we suggest that the 'Pre-Installation Check List' be completed prior to contacting your nearest Lepel district sales and service office to make an appointment.

Water and power lines must be connected and fixtures, load coils and work samples must be available when the field engineer arrives.

SECTION IV

4. SAFETY

WARNING: If for any reason, the safety interlock switches are bypassed and the generator is operated with the panels removed, alternating and direct voltages in excess of 4,000 volts will be exposed. These voltages may be fatal upon contact.

Since residual charges may remain in the capacitors for some time the generator is shut off, these capacitors should be discharged before servicing.

When in operation, all panels must be securely fastened. When any panel is removed, the safety interlock switch automatically deactivates all high voltage circuits. However, the hazards normally accompanying the servicing of line voltage control circuits are still present and only qualified personnel should be permitted to work on such circuits.

Since high frequency voltages can produce arcs and burns, operators must be instructed not to touch the load coil or load coil leads when the RF power is on. Appropriate guards must be provided to preclude the possibility of such contact. Since the workpiece may be very hot, both during and for some time after heating, the usual caution associated with such objects should be carefully observed.

NOTE: Where long load coil lead lengths are required, Lepel can supply coaxial lines which will meet both safety and electrical requirements.

5. GENERATOR SET-UP

5.1 Preliminary

1. Connect the load coil to the generator output terminals (do not apply any pipe sealant).

2. Slowly turn on the water supply and carefully check the oscillator tube and associated water connections for leaks.

3. With the disconnect switch and circuit breaker in the 'Off' position check the line voltage at the disconnect switch and set the taps of the filament and plate transformers to the value closest to that of the measured voltage.

4. Apply power to the circuit breaker, CB1, by setting the disconnect switch to 'On'.

5. Apply power to the generator by setting the circuit breaker, CB1 to 'On' (This will energize the control and filament circuits).

6. With a free flow of water now exiting from both water outlet lines, check for any water leaks.

5.2 Starting-Up

WARNING: Access panels are equipped with safety interlock switches which automatically deactivate all high voltage circuits. Therefore, remove at least one panel before steps 1 and 2 so that the plate power cannot be accidentally activated.

5.2 (Cont'd)

1. After the generator has been on for four or five minutes, check voltage at the filament terminals of the oscillator tube. If it departs from the values given in the 'Specifications' (page 2), set the disconnect switch and circuit breaker to OFF. Adjust filament transformer taps as required.

WARNING: Always set the circuit breaker to OFF before adjusting the tank coil slider.

CAUTION: Do not operate the generator without a workpiece in the load coil.

2. Temporarily set tank coil slider to tap no. 1.
3. Insert a workpiece into load coil.
4. Replace all panels.
5. Set disconnect switch and circuit breaker to ON.
6. Plug footswitch into appropriate receptacle on front panel.

For Optional Timer Operation

7. Plug timer into appropriate receptacle on front panel.
8. Plug footswitch into receptacle on timer.
9. Press footswitch for timed heat cycle.

For Pushbutton Operation

7. Press START switch to start generator.
8. Press STOP switch to stop generator.

5.3 Final Adjustments

1. Set POWER CONTROL to zero.
2. Adjust GRID CONTROL to 50.
3. Press START switch.
4. Press footswitch. PLATE meter and GRID meter read low values - readings vary with load coil size and mass and resistivity of workload.
5. Depress footswitch.
6. Slowly adjust POWER CONTROL cw until GRID meter reads 165-250 ma. The PLATE meter may read less than 0.83 amps if the tank coil slider is set to the no.1 tap.
7. To increase PLATE meter reading, adjust POWER CONTROL to fully cw position and adjust tank coil slider to a higher numbered tap until the PLATE meter reading is approximately 0.83 amps.

5.3 (Cont'd)

AT THE SAME TIME, ADJUST THE GRID CONTROL TO ESTABLISH THE GRID CURRENT WITHIN ITS SPECIFIED LIMITS OF 165 MA TO 250 MA. (SEE GRAPH, PAGE 28). THE 'POWER CONTROL' CAN NOW BE SET FROM PRACTICALLY ZERO TO MAXIMUM AND THE PLATE CURRENT WILL TRACK WITH THE GRID CURRENT.

THE GENERATOR IS NOW ADJUSTED FOR MAXIMUM POWER OUTPUT

5.4 Practical Operating Considerations

In some applications optimum loading and maximum generator output may be neither practical nor desirable; two possible conditions are:

1. If optimum loading has been achieved through the selection of tank coil taps, heating rate may be decreased either by setting the 'Power Control' to a lower number or by moving the tank coil slider to a lower numbered tap. The latter approach is preferable to that of using a very low 'Power Control' setting.

2. If a load coil/workpiece combination is used where a satisfactory heating rate is obtained with plate current at less than its maximum permissible value, no further adjustments are necessary.

The maximum permissible plate current is fixed by the tube manufacturer and should not be exceeded. See 'Specifications' (page 2).

5.4 (Cont'd)

If plate current reaches its maximum permissible value before the 'Power Control' reaches maximum, decrease plate current by relocating the tank coil slider to a lower numbered tap.

If the maximum permissible plate current is exceeded, the plate overload relay will deactivate plate power and the tank coil slider should likewise be relocated to a lower numbered tap.

The relay will automatically restore itself and plate power can be applied after a 15 second delay.

The maximum permissible grid current is fixed by the tube manufacturer and must be carefully observed. See 'Specifications' (page 2).

CAUTION: If grid current is at zero or is drifting down towards zero while plate current is rising, immediately shut off plate power. This is an indication that oscillation is stopping and plate current without oscillation can result in tube damage due to overheating.

Never operate the generator with grid current at less than its minimum permissible value (see Graph, page 26).

If grid current reaches its maximum permissible value before the 'Power Control' reaches maximum (or exceeds this valve at the maximum 'Power Control' setting) adjust the 'Grid Control' to bring grid current back into its permissible limits.

5.4 (Cont'd)

If sufficient grid current cannot be obtained through use of the 'Grid Control' adjustment, increase the clearance between the load coil and workpiece and/or reduce the number of turns on the load coil.

CAUTION: An oscillator tube damaged due to overdriving or underdriving the grid is not covered by the manufacturers warranty.

Once the desired settings have been established, record them for subsequent use.

When heating ferrous materials, plate and grid currents will vary throughout the heating cycle. Plate current should reach its maximum allowable value while grid current should vary within its specified limits.

After heating the ferrous workpiece to about $1400^{o}F$ (Curie point), plate current will drop and grid current will rise (this plate and grid current swing does not occur when heating non-ferrous materials.)

It may be necessary when setting-up the generator to heat a ferrous workpiece, to readjust the tank coil slider and plate and grid controls several times in order to achieve the proper heating rate.

Whenever either the load coil or workpiece is changed, some readjustment of the controls will be necessary.

When heating non-ferrous materials, the load coil should be designed with as many turns as possible surrounding the workpiece. The load coil inductance, however, must not exceed 12 michrohenries.

5.5 Shutting down the generator

1. Press 'Stop' pushbutton.
2. Set the circuit breaker to 'Off'.
3. After a delay of at least five minutes, turn off the water supply.
4. Set the disconnect switch to 'Off'.

THE SHUTDOWN IS COMPLETE

5.6 Condensed Operating Sequence

CAUTION: The operating sequence described below is applicable only to generators that have been properly installed and are in perfect operating condition, it is essential that the preceding sections of this manual be completely understood before any atttempt is made to start up the generator.

STEP	REMARKS
1. With the load coil connected to the RF output terminals locate the work-piece within the load coil.	
2. Plug foot switch into receptacle.	
3. Set the external disconnect switch to 'On'.	
4. Turn on the local water supply	Check for leaks

5.6 (Cont'd)

STEP	REMARKS
5. Set the power control to zero	
6. Set the circuit breaker to 'On'.	Filament lamp comes on.
7. Push the 'Plate Start' pushbutton. Adjust plate and grid controls as required.	Plate lamp comes on.

SECTION VI

6. GENERAL CARE AND MAINTENANCE

The following required routine maintenance should start three months after installation and be repeated every six months thereafter.

1. Clean the high voltage insulation, which includes ceramic insulators, rubber hoses, glass envelope of the oscillator tube, etc. (This is especially important in the presence of corrosive or contaminating vapors.)

2. Clean the water strainer screen and check for breaks.

3. Remove the oscillator tube and clean the water cooled anode by applying very fine sandpaper. Install a new sealing gasket lightly coated with silicon grease or petrolium jelly before reinstalling the oscillator tube. The filament and grid connections should likewise be cleaned and securely reconnected.

TROUBLE SHOOTING GUIDE for schematic diagram No. T-254-229

TROUBLE	PROBABLE CAUSE	CHECK
No filament voltage	a. Defective main fuse	F1
	b. Open circuit breaker	CB1
	c. Insufficient water flow	
	d. Defective water flow switch	S1
	e. Defective oscillator filament transformer	T2
Plate contactor fails to close	a. Defective plate contactor	K3
	b. Defective time delay relay	K2
	c. Open safety interlock switch	S4 Thru S7
Plate overload relay trips as soon as plate power is applied	a. Load coil over-coupled (reduce tap setting)	
	b. Shorted plate blocking capacitor	C2
	c. Shorted grid bypass capacitor	
	d. Shorted tank capacitor	C3, C4
	e. Shorted rectifier filter capacitor	
	f. Defective oscillator tube	V1
	g. Defective rectifier	CR1 Thru C
No R.F. Power output contactor operating (no reading on plate current meter)	a. Defective oscillator tube	V1
	b. Open circuit in DC power supply	
	c. Defective plate transformer	T1
	d. Insufficient grid drive (increase grid control setting)	
	e. Open tank circuit	
Plate current present but no grid (no reading on grid current meter)	a. High resistance contact or loose connection in tank circuit	
	b. Open plate blocking capacitor	
	c. Defective oscillator tube	V1
	d. Open grid circuit	
	e. Insufficient grid drive (increase grid control dial setting)	
	f. Defective grid resistor	R4

SECTION VIII

8. SPARE PARTS LIST

For uninterrupted production it is suggested that the following replacement parts be stocked:

Quantity	Description	Reference Designation	Lepel Stock No.
1	Oscillator Tube (see note 1)	V1	018-0004
1	Capacitor	C2,C3,C8	007-0005
1	Grid Resistor	R4	038-0014
2	"O" Ring for Oscillator Tube Jacket		034-0020
1	Isolation Hose Assembly For Oscillator Tube		043-0049
2	Rectifier	CR1 to CR4	016-0034
1	Controller		050-0032
5 ft.	Rubber Hose		575-0013
1	Tank Coil Assy.		043-0057

NOTE:

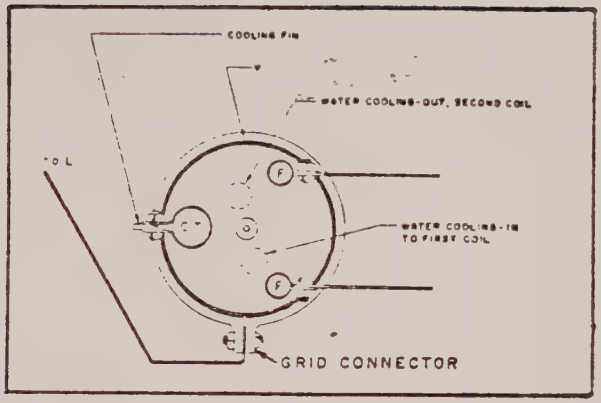
1. The replacement oscillator tube should be rotated with the one in the generator every 6 months so that a field-tested tube will always be ready for emergency use.

SECTION IX

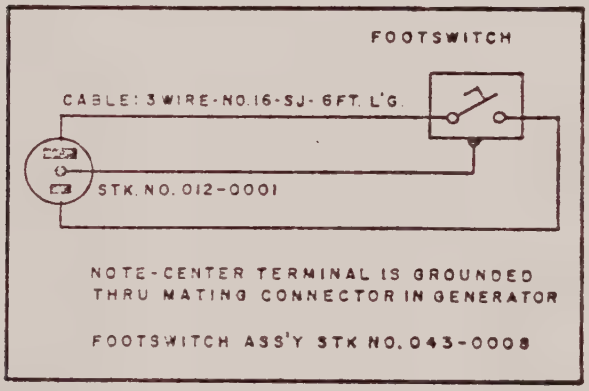
9. ADDENDUM TO BILL OF MATERIALS

NO. REQ.	ITEM	STOCK NO.
1	Oscillator Tube Jacket	043-0016
1	Oscillator Tube Jacket Washer	034-0020
2	Oscillator Tube Filament Connector	045-0001
1	Oscillator Tube Grid Connector	045-0002
1	Oscillator Tube Cooling Fin	045-0003
2	Oscillator Tube Hose Fitting	525-0002*
2	Stand-Off Insulator For Oscillator Tube Mounting Plate	025-0048
1	Oscillator Tube Mounting Plate	Drawing No. 16660079
1	Tank Capacitor Isolation Hose Assy.	Drawing No. 3620022
1	Tank Coil Assembly	043-0030
2	Stand-Off Insulator Grid Res. Mtg.	025-0011

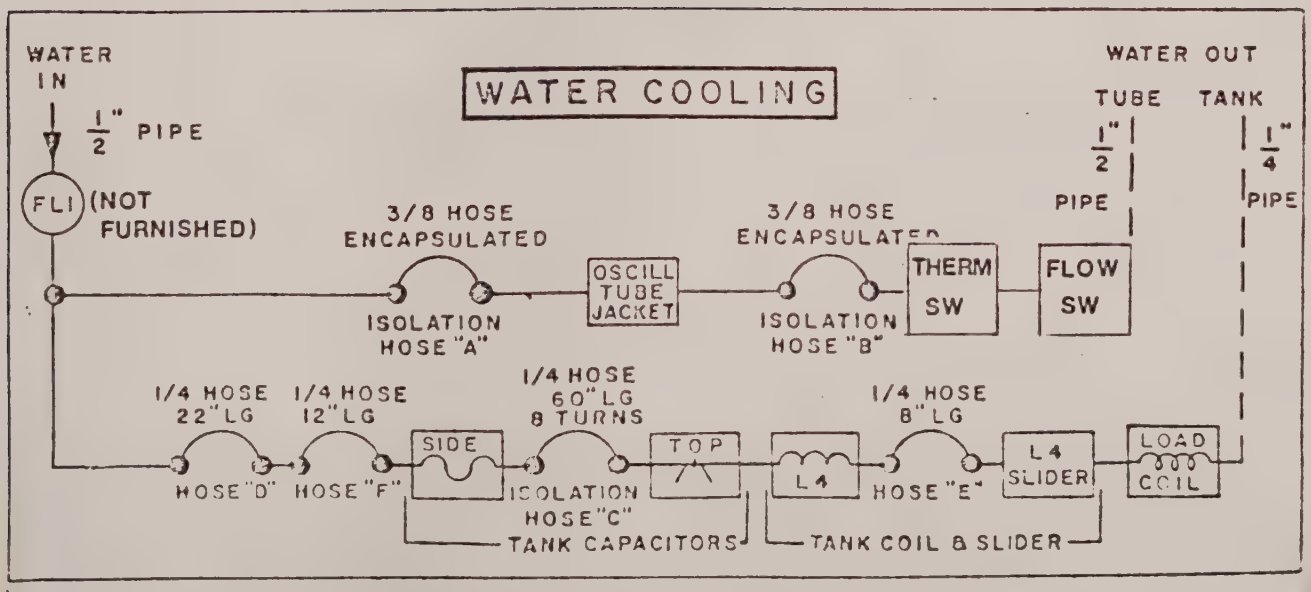
* Part of 043-0016



OSCILLATOR TUBE CONNECTIONS
(VACUUM SYSTEMS: AS APPLICABLE TUBE TYPE TO POWER CONTROL)


FOOTSWITCH
CABLE: 3 WIRE-NO.16-SJ-6FT. L'G.
STK. NO. 012-0001
NOTE-CENTER TERMINAL IS GROUNDED THRU MATING CONNECTOR IN GENERATOR
FOOTSWITCH ASS'Y STK NO. 043-0008

FOOTSWITCH SCHEMATIC



WATER FLOW DIAGRAM

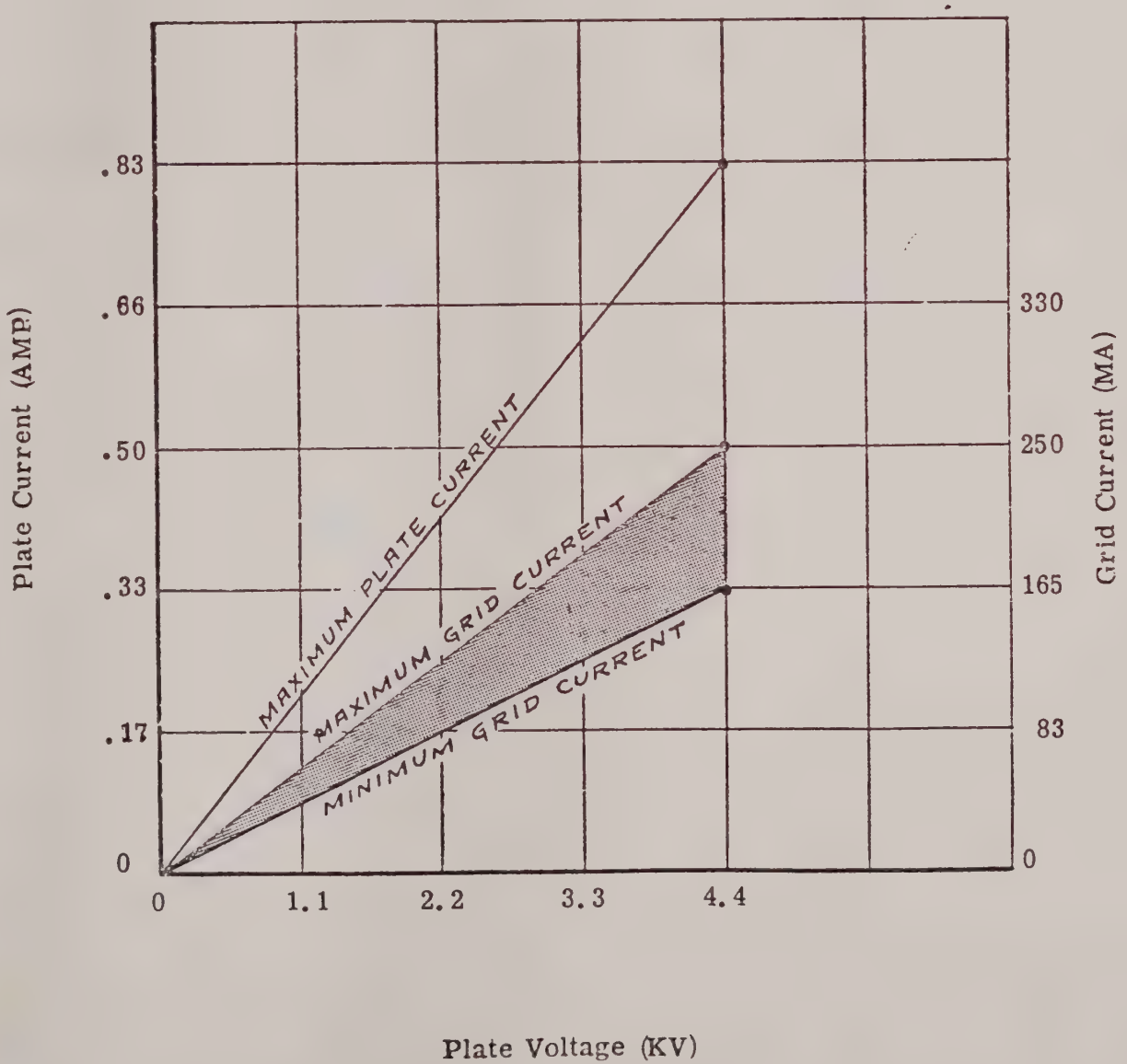
Recommended Grid and Plate Current Ranges

Versus

Plate Voltage

For Tube Type 6960

(Generator T-2.5)



LEPEL CORPORATION

GENERATOR INSTALLATION SPECIFICATIONS

NOTE: 1 — NOTE: 2

GENERATOR MODEL	POWER INPUT KVA	POWER INPUT PHASE	INPUT LINE VOLTS	FULL LOAD CURRENT AMPS	ELECTRICAL SERVICE FUSE AMPS	ELECTRICAL SERVICE CABLE AWG MCM	WATER REQ.** GPM	WATER FITTING NPT*** INLET	WATER FITTING NPT*** OUTLET
T-1-1	2.4	1	115	21	40	8	1	*1/4	* 1/4
T-2.5	5.5	1	230	24	40	8	3	*1/2	*1/2 *1/4
			460	12	25	10			
T-5-3	12.7	3	230	32	45	8	4	*1/2	*1/2 *1/4
			460	16	30	10			
			550	13.5	25				
T-7.5-3	16.7	3	230	42	60	6	4	1/2	*1/2 3/8 3/8
			460	21	30	10			
			550	17.5					
T-10-3	25.4	3	230	64	110	2	8	1	1-1/4
			460	32	60	6			
			550	27					
T-15-3	32.8	3	230	82	125	1	10	1	1-1/4
			460	41	80	4			
			550	34					
T-20-3	46	3	230	116	175	00	10	1	1-1/4
			460	58	80	4			
			550	47					
T-25-3	58	3	230	144	250	250	14	1	1-1/4
			460	72	125	1			
			550	60					
T-30-3	68	3	230	170	250	250	14	1	1-1/4
			460	85	125	1			
			550	71					
T-35-3	80	3	230	200	300	350	22	1	1-1/4
			460	100	175	00			
			550	84	125	1			
T-40-3	89	3	230	224	350	500	22	1	1-1/4
			460	112	175	00			
			550	94					
T-50-3	120	3	230	300	450	700	22	1	1-1/4
			460	150	250	250			
			550	120	175	00			
T-60-3	143	3	230	360	500	——	22	1	1-1/4
			460	180	250	——			
			550	150					
T-80-3	192	3	230	480	800	——	30	1 ****	1-1/4 ****
			460	240	400	——			
			550	200	350	——			
T-100-3	240	3	230	600	1000	——	35	1 ****	1-1/4 ****
			460	300	450	——			
			550	250	400	——			
T-125	298	3	460	375	550	750	40	1-1/2	1-1/2 *
T-160	348	3	460	500	700	750	65	1-1/2	2" *
T-200	475	3	460	600	800	——	65	1-1/2	2" *
T-250	541	3	460	680	800	——	85	2"	4" *

COOLING WATER NOTES

* Denotes water hose nozzle.

** The inlet pressure must fall between 40 PSI, the minimum pressure required to maintain the specified flow rate shown, and 65 PSI, the maximum allowable pressure.

If the inlet pressure falls below 40 PSI, install a booster pump in the water supply line.

If the inlet pressure exceeds 65 PSI install a pressure regulator in the water supply line.

Water inlet temperature must not exceed 80°F (70°F if the generator is equipped with the sealed cabinet air cooling).

When a generator is supplied with a water recirculator utilizing a water to water heat exchanger, the consumption of city water is automatically adjusted to the varying cooling requirements of the generator.

When a generator is so-equipped, the water supply requirements increase by 3 GPM for generators from T-10-3 to T-40-3 and by 5 GPM for generators from T-50-3 to T-100-3.

*** To insure an adequate flow, the sizes of the water supply and drain lines should equal or exceed those of the 'inlet' and 'outlet' fitting sizes.

Gravity outlet drains are recommended.

If the use of an overhead drain is unavoidable, install a check valve in this line NEVER a manually operated valve.

**** 1 1/2" when a water recirculator is used.

ELECTRICAL NOTES

1. For information on generator models not listed please contact Lepel Corporation.
2. 'Full Load Current Amps' are based on the 'Input Line Volts' which are nominal values. Lepel generators, however, are designed to operate over the following voltage ranges and the 'Electrical Service' listing is based on the maximum line current requirements for the lowest acceptable line voltage as listed below:

Nominal	Range
115 Volts	105 Volts to 125 Volts
230 Volts	200 Volts to 250 Volts
460 Volts	400 Volts to 500 Volts
550 Volts	500 Volts to 600 Volts

In general, Lepel line circuit breakers are rated at 125% of this maximum line current.
The cable sizes listed conform to the National Electrical Code for copper conductors rated at 75° C. It is, however, recommended that the user consult the local electrical code requirements for conductor ampacities.

* *Includes Recirculator Input Power.

DWG. NO. 9570041
REV. 10-17-80

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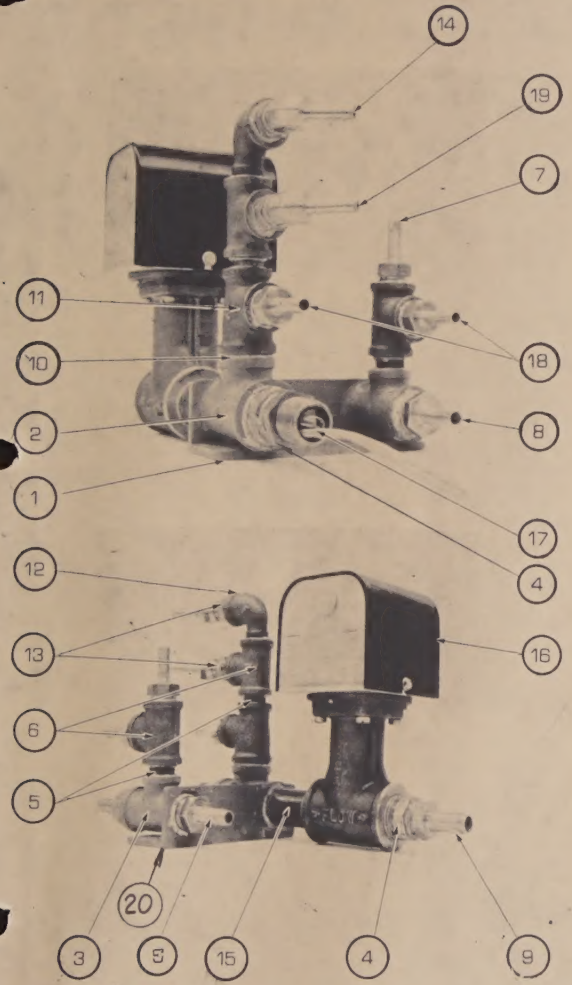
LEPEL
STOCK NUMBER
1306-0003

REVISIONS				
SYM	ZONE	DESCRIPTION	DATE	APPROVAL
A		ADDED ITEM 20 DELETED ITEMS 1, 2 & 3	9-1483	R. Wilkerson MLV



Item	Qty	Part No.	Description	Specification
20	1	STK.NO.1306-0004	MANIFOLD, WATER	DWG.NO.13170049
19	1	Stk No. 1413-0030	Nozzle, Hose-Elbow - 45°	BRS - 3/8 Hose x 1/4 NPT
18	2	Stk No. 1413-0012	Nozzle, Hose	BRS - 3/8 Hose x 3/8 NPT
17	1	Stk No. 044-0002	Switch, Thermostat	1/2 NPT - Temp. Range 90°-400°F
16	1	Stk No. 044-0125	Switch, Water Flow	3/4 NPT - Close at 2.5 GPM
15	1		Nipple	BRS - 3/4 NPT x 3 1/2 LG
14	1	Stk No. 1413-0029	Nozzle, Hose - Elbow - 45°	BRS - 1/4 Hose x 1/4 NPT
13	2	Stk No. 626-0033	Bushing, Reducing	BRS - 3/8 x 1/4 NPT
12	1		Elbow, Street - 90°	BRZ - 3/8 NPT
11	1		Tee, Reducing	BRZ - 1/2 x 3/8 x 3/8 NPT
10	1	Stk No. 626-0085	Nipple, Close	BRS - 1/2 NPT
9	2	Stk No. 1413-0004	Nozzle, Hose	BRS - 1/2 Hose x 1/2 NPT
8	1	Stk No. 1413-0005	Nozzle, Hose	BRS - 3/8 Hose x 1/2 NPT
7	1	Stk No. 1413-0019	Nozzle, Hose	BRS - 1/4 Hose x 3/8 NPT
6	2		Tee	BRZ - 3/8 NPT
5	2		Nipple, Close	BRS - 3/8 NPT
4	2		Bushing, Reducing	BRS - 3/4 x 1/2 NPT
~~3~~	~~1~~		~~Tee, Reducing~~	~~BRZ - 1/2 x 1/2 x 3/8 NPT~~
~~2~~	~~1~~		~~Tee, Reducing~~	~~BRZ - 3/4 x 3/4 x 1/2 NPT~~
~~1~~	~~1~~		~~Angle~~	~~BRS - 1 1/2 x 1 1/2 x 3/16 x 5 LG~~

NEXT ASSY APPLICATION	USED ON
	T-7.5B
	T-5B
	T-2.5
	Lepak 500M
	Lepak 500
	Lepak 250M
	Lepak 250

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES
TOLERANCE ON: FRACTIONS ± DECIMALS ± ANGLES ±

DRAWN BY V. Usefof DATE 6/16/83
CHECKED W. Klemm DATE 6/16/83
APPROVED FOR MFG DATE
ENGINEER R. Howard DATE 9/6/83

NAME
Manifold Assy, Water
Lepak 250, 250M, 500, 500M
T-2.5, T-5B & T-7.5B
(Photo Drawing)

MATERIAL
FINISH

DWG SIZE B
DRAWING NO. 13170048
REV A
SCALE
SHEET 1 OF 1

LEPEL CORPORATION
50-21 QUEENS MIDTOWN EXPRESSWAY
MASPETH, N.Y.C. 11378

10-7156

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